REMARKS/ARGUMENTS

Favorable reconsideration of this application, in view of the above amendments and in light of the following discussion, is respectfully requested.

Claims 1 and 3-5 are pending in the present application. In the outstanding Office Action, Claims 1 and 3-5 were rejected under 35 U.S.C. § 103(a) as unpatentable over U.S. Patent No. 6,183,627 to Friday in view of U.S. Patent No. 5,944,961 to Gandman.

The applied art does not teach or suggest a step of thermally cracking in a thermal cracking section, the heavy oil content obtained directly from a bottom of the distilling section so that a lightened thermally cracked product and residues of pitch or coke are produced, and a step of removing the residues of pitch or coke from the thermally cracking section, as recited in Claim 1.

Friday's thermal cracking is different from Severe thermal cracking in one or more embodiments of the present invention. Specifically, the Block flow diagrams of FIGs. 1 and 2 of Friday show the thermal cracked product with a single stream line. In our process industry's field, it is common that streams with a small amount of flow rate can be usually erased from the simplified block flow diagram unless the erasing of those streams is contrary to correctly presenting the processing philosophy or concept. The streams which can be erased from the diagram are such as an off-gas stream, a light oil stream with small amount, an acid gas stream and the like. However, since an amount of thermal cracked residue such as coke or pitch accounts for a large amount, which reaches 1.0 to 1.5 times of the Carbon Residue such as Conradson carbon residue (CCR) or Ramsbottom carbon residue, nearly corresponding to the coke precursor, the erase of the thermal cracked residue stream from the block flow diagram causes a misunderstanding the process concept and should not be made. Accordingly, the thermal cracked residue stream means a major stream due to the large

amount, and the process philosophy does not permit to erase the stream from the block flow diagram.

Since the block flow diagram of Friday indicates a single product stream line on the thermal cracking section, it is concluded that the thermal cracking in the Friday is in a category of "Mild thermal cracking" without any separation device of the thermal cracked residue from the product liquid.

Accordingly, Friday's concept is a Mild thermal cracking + Solvent Deasphalting. However, embodiments of the invention are directed to severe thermal cracking categorized into Coking, in which removing device of coke or pitch is equipped.

Severe thermal cracking in the present invention needs no solvent deasphalting (SDA), while the SDA is essential in the Friday reference.

A thermal cracking temperature in the severe thermal cracking (such as in Coker) is so high to vaporize the cracked product and as a result a coke or pitch is separated from the cracked product, while the mild thermal cracking has not so high temperature to separate thermal cracked residue from the cracked product. Naturally, the severe thermal cracking process becomes having a facility to remove the thermal cracked residue, while the mild thermal cracking process has no such device to remove the residue, rather a whole liquid product containing residue is produced. The liquid product containing light and heavy cracked products in the Friday is further thermally cracked after removing an asphaltenic coke precursor in the solvent deasphalting (SDA).

Accordingly, it is concluded that the present invention and Friday are distinguishable with respect to at least the reaction, the removal of coke precursor, facility configuration in the reaction section and the processing scheme.

With respect to the Office Action's assertions at page 4 bottom paragraph, that it would have been "obvious to eliminate the solvent Deasphalting step of Friday because the

removal of asphaltenes permits the operation of the cracker at more severe conditions and higher conversions. If one could put up with lesser conversion with reduced costs from the elimination of the deasphalting step, one would be motivated to eliminate the deasphalting step. Also, by eliminating this step, residues of coke and pitch would be produced." Applicants respectfully disagree with this assertion. Specifically, Friday's thermal cracking does not separate coke or pitch, and such coke precursor is solved stably in the liquid product with a function of the hydrogen donor. However, if the deasphalting step would be eliminated, since the coke precursor goes back to the distillation section, almost all the coke precursor is recycled to the thermal cracking section. The Coke precursor amounts to 10 to 25 wt% in a vacuum residue at least, as discussed before. If the CCR of the deasphalted oil could be reduced to 45% of that in the vacuum residue in the SDA, it would become 4.5 to 11 wt%. The amount of the coke precursor accounts for 140 (CCR 4.5 wt% x 1.0(min) x 20,000 BPD) to 450 (CCR 11 wt% x 1.5(max) x 20,000 BPD) ton/d at a typical one unit capacity of 20,000 BPD. Since such a coke precursor has no outlet where it's drawn off from the system in the Friday, the total amount of the coke precursor deposits inside the thermal cracking section. Even if the severity would be reduced, since such amount of coke precursor does not change and recycled to the thermal cracking section, the cracking section will shut down due to the coke deposition with time. Actually, a facility can be shut down in several hours and require a tough cleaning work resulting in a shut-down for several weeks. As such, the removal of SDA from Friday is impracticable.

Consequently, the solvent deasphalting as an outlet of the coke precursor is essential in Friday. The Friday invention is limited in utilizing the solvent deasphalting.

With respect to the Office Action's assertion on page 5 line 16 that "it also would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the process of the Friday reference by assuring that none of the heavy oil is

contained in the thermal cracking residue because 100 percent conversion will result in the maximum production of the lighter cracked oil product." Applicants respectfully disagree. Specifically, Friday is characterized by the liquid phase mild thermal cracking without separating coke or pitch, the thermal cracking residue contains the light cracked oil as well as heavy oil. In contrast, Claim 5 recites that no heavy oil content is contained in the thermal cracking residue. It is a key claim to distinguish "Coking (Or severe thermal cracking)" and "Mild thermal cracking" in the present invention. Consequently, 100% conversion is completed only by the coking, but can not be attained by the mild thermal cracking in Friday.

With respect to the Office Action's assertion on page 5 bottom paragraph that "also, Sandman discloses of step of injecting a liquid solution in order to remove coke from a thermal cracking furnace," applicant's respectfully disagree. Specifically, a small amount of coke precursor tends to deposit on tube/vessel/heat exchanger walls in the broad thermal processing such as from heating to cracking. In such processing, aromatic solvent to dissolve the coke precursor and a fluid jet to mechanically detach a coke on the wall are effectively utilized in a broad application. We understand Gandman is one of technologies in such a device to depress a coking from a small amount of coke precursor inside a process equipment and piping. However, the technology such as the present invention and the Friday handles a large amount of coke precursor.

To depress coking and fouling in the thermal cracking section, the hydrogen donor diluent is added to the deasphalted oil 1 part at about 0.25 to 4 parts in the Friday. The combined stream of the deasphalted oil and hydrogen donor goes back to the distillation column after the thermal cracking. Therefore, the quantity of combined stream, which is charged to the distillation, increases largely from 125% to 500% of the original deasphalted oil. It provides with a large impact on the size of distillation column. In contrast, embodiments of the present invention have an advantage due to no injection of the hydrogen

donor diluent. Therefore, it can be seen that the Friday requires quite large capacity of facility to depress the coking. Also from the quantitative point of view, the present invention is different from Friday with respect to concept and philosophy.

With respect to an impact on energy consumption, the stream with a large amount of flow rate in the above discussion goes back to the distillation section and is heated again to be evaporated in the distillation, because the stream is a liquid phase and not with a high temperature. In case of a large amount of donor injection, larger feed to the distillation leads to an input of larger energy in a charge oil heating furnace of the distillation. That is, it means that the hydrogen donor method provides with larger energy consumption, which is contrary to a desire to save energy.

Accordingly, Claim 1 recites that "the step of separating the crude oil by distillation and said step of separating the lightened thermally cracked product by distillation are carried out at the same time in the distilling section including a pre-separating apparatus and a vacuum distillation apparatus as a main separating apparatus." As such, since the thermal cracking product is distilled in the same distillation facility as a crude oil, the thermal cracked vapor is directly charged to the distillation and the high temperature vapor energy is efficiently utilized to vaporize the crude oil. As the result, a firing energy in crude oil heating furnace is minimized, actually to zero in a normal operation, and an energy-saving is uniquely accomplished.

Accordingly, the actual effect based on operations inside the processing according to the claimed invention is different from that of Friday.

Again, Applicants would like to stress that:

Friday concept = Thermal cracking + Solvent Deasphalting

Where, thermal cracking includes coking and mild thermal cracking, in a quite broad sense, whereas Applicants assert that:

Friday concept = Mild thermal cracking + Solvent Deasphalting.

That is, Mild thermal cracking: Residue thermal cracking which is not equipped with removing device of coke or pitch, in which the severity of residue cracking is mild. Since the cracking occurs in the liquid phase and cracked light product is not separated from residue remained in the same liquid phase, residual fuel oil is produced as well as cracked gas, distillate oil. Coking process (corresponding to the present invention): Residue thermal cracking which is equipped with removing device of coke or pitch, in which a severity of residue cracking is maximized. Since cracked light product is vaporized and separated from liquid phase of cracked residue (eventually shifted to coke or pitch) inside the coking process, the residue conversion to light product is completely maximized and no residual fuel oil is produced, but cracked gas, distillate oil and coke or pitch are produced.

In the mild thermal cracking, since the reaction severity is mild, the reaction is kept in a liquid phase. On the other hand, in the coking process, since the severity is quite higher than the mild thermal cracking, cracked light product is totally vaporized from the liquid phase, in which the cracked residue remains. It can be seen from the above discussion that philosophy in configuring the cracking reaction is different between the mild thermal cracking and the coking processes.

While the coking and mild thermal cracking are categorized into the same thermal cracking, the facility, technology in the reaction and process concept are different. In the coking process, 1) the severity of residue cracking is not adjusted, because a level of residue conversion to light product is always maximized; 2) the combination with the solvent deasphalting is unnecessary; and 3) hydrogen donor is unnecessary for cracking purpose.

Again, Claim 1 recites the step of removing the residues of pitch or coke from the thermal cracking section. Thus, coke or pitch is produced and drawn off from the processing system. Since the thermal cracking process of exemplary embodiments of the present

invention is to be utilized not for selective reactions to certain products, but for a broad range of productions from light to heavy materials including coke precursors with the above-noted condensed large molecule, the feature of drawing off the heavy materials from the processing system with a thermal cracking is essential at the more severe conditions and higher conversion. Such intended production of coke or pitch is clearly different from unintended accumulation of coke or pitch in Friday because no problems, such as fouling and deposition of coke or pitch, occur as the coke or pitch produced is drawn off from the processing system.

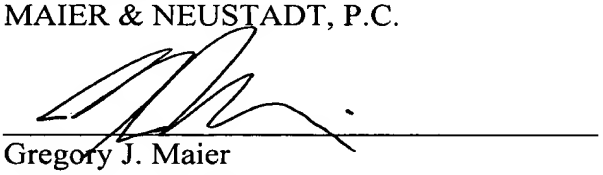
Accordingly, Applicants respectfully request the withdrawal of the rejection of the Claims under 35 U.S.C § 103(a).

Consequently, for the reasons discussed in detail above, no further issues are believed to be outstanding in the present application, and the present application is believed to be in condition for formal allowance. Therefore, a Notice of Allowance is earnestly solicited.

Should the Examiner deem that any further action is necessary to place this application in even better form for allowance, the Examiner is encouraged to contact the undersigned representative at the below listed telephone number.

Respectfully submitted,

OBLON, SPIVAK, McCLELLAND,
MAIER & NEUSTADT, P.C.



Gregory J. Maier
Attorney of Record
Registration No. 25,599

Kevin M. McKinley
Registration No. 43,794

Customer Number
22850

Tel: (703) 413-3000
Fax: (703) 413 -2220
(OSMMN 03/06)
KMM/rac